# EVALUATION OF THE DISPLAY FORMAT OF CLARKE'S TRAUMA PROGRAM FOR WOUNDS TO THE ABDOMEN

by

Karen FISHERKELLER

NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

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Research Work Unit MM33C30.002-5004

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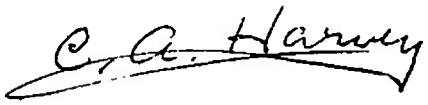

C. A. HARVEY, CAPT, MC, USN
Commanding Officer
NavSubMedRschLab

## SUMMARY PAGE

### THE PROBLEM

To evaluate and compare the display format of a computer based trauma program for penetrating wounds to the abdomen to existing computer based diagnostic programs for acute abdominal pain and chest pain.

### THE FINDINGS

Display format differences between the trauma program and existing abdominal and chest pain programs were identified and changes were suggested to make the format of the trauma program more consistent with that of the existing programs.

### APPLICATION

The Corpsman's use of different computer based diagnostic modules for the management of medical problems that arise at sea will be facilitated by the use of similar user interfaces and display formats for different modules.

## ADIMINSTRATIVE INFORMATION

This project was conducted under Naval Medical Research and Development Command Work Unit No. MM33C30.002-5004. It was submitted for review on June 8, 1988 and approved for publication on September 9, 1988. It has been designated as Naval Submarine Medical Research Laboratory Memo Report No. 88-1.

## ABSTRACT

This report examines from a human factors point of view a computer-based trauma program for penetrating wounds to the abdomen. The program was developed by John Clarke, M.D. at the Medical College of Pennsylvania, Philadelphia, PA. The report compares the display format of the trauma program to that of the existing abdominal pain (ABDX) and chest pain (CPDX) diagnostic programs. Format differences are identified and changes are suggested to make the format of the trauma program more consistent with that of ABDX/CPDX.

**Evaluation of the Display Format of Clarke's Trauma Program for Penetrating Wounds to the Abdomen**

## INTRODUCTION

A computer-based medical diagnostic/information system has been developed to assist the Navy Submarine Corpsman in the management and treatment of medical problems that arise at sea. Two modules, in the areas of acute abdominal pain and chest pain have been completed thus far. Plans for additional modules include psychiatric disorders, dental emergencies, ophthalmologic problems and wounds. In order to facilitate the corpsmen's use of additional programs, the user interface of new modules should be as similar as possible to existing ones, without compromising program content.

A computer-based diagnostic program for penetrating wounds to the abdomen has been developed by John Clarke at the Medical College of Pennsylvania, Philadelphia, PA.. At this time, Dr. Clarke's program considers only penetrating wounds to the abdomen caused by stabs or gunshots. The final trauma program will address other kinds of penetrating trauma (i.e. shrapnel), blunt force trauma, and trauma to locations other than the abdomen.

This report examines from a human factors point of view the display format of Clarke's current diagnostic program. It does not evaluate the medical content of the program. The report compares the display of the trauma program to that of the existing abdominal pain (ABDX) and chest pain (CPDX) diagnostic programs so that the final version of the trauma program can be as similar as possible in format to the existing programs without loss of program content and the need for extensive retraining. The report is divided into two sections. Section I displays successive pages of Clarke's trauma program along with comments identifying format differences and suggestions to make the format of the current trauma program more consistent with that of ABDX/CPDX. Pages of the trauma program are displayed in standard type and comments relating to the program are in bold type. In Section II, the trauma program is presented in the same format used with ABDX/CPDX.

SECTION I

**Title Page:**

Multiple Trauma Consultation System
Customized for use on a personal computer onboard a submarine

Developed jointly at the University of Pennsylvania
and at the Medical College of Pennsylvania by
Michael Niv (Penn)
John Clarke MD (MCP)
Bonnie Webber PhD (Penn)
and David Cebula MSE (Penn)

This program is designed to provide advice to a medical corpsman at sea in the management of patients suffering from a penetrating injury to the abdomen. The program is menu-oriented and straight-forward to use. Some hints: Look at the bottom line of the screen for hints; use the ESC key to move on -- to skip a menu; use the F10 key to see what the computer knows and has concluded so far. This system is documented in the MTCS-PC Manual.

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**COMMENT: The title page includes general instructions regarding use of the program. This page is displayed for approximately 10 seconds, which is not enough time to read it. General instructions regarding the use of the program and special keys should be included as a selection on the main menu. After the title page, the user is taken to the first datasheet display page (here called Page 1). It would be preferable to go from the title page, to a main menu. The main menu should include at least the following selections: Real Case, Simulated Case, General Instructions, Exit System. The program should store real cases on disk. In ABDX/CPDX, a distinction is made between real cases and simulated cases so that the program can be used as a training tool. Only the last simulated case is stored. If entry of a real case is selected, then the user must enter the SSN as identifying information. The main menu of the Abdominal Pain Diagnostic Program is shown in Figure 1.**

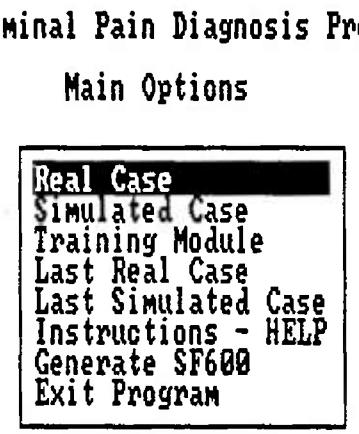



**Figure 1. Main Menu of the Abdominal Pain Diagnostic Program**

**Trauma Symptom Page 1:**

WOUND TYPE
A. STAB
B. GUNSHOT

**Definition for WOUND TYPE:**

Select the type of wound to the abdomen. To make a choice, simply type the letter corresponding to your selection. If you do not wish to answer a question, press ESC to move on to the next one. In case you wish to exit the system without using it, press ESC until you see the main menu, then select choice D, to exit the system.

**COMMENT: The definition of Wound Type provides general instructions on program usage. General instructions should be included as a selection on the main menu.**

**Trauma Symptom Page 2:**

WOUND LOCATION
- A. ABDOMEN
- B. CHEST
- C. PELVIS

**Definition for Wound Location:**

The abdomen is defined as the region between the ribs and the pelvis, anteriorly or posteriorly. After answering this question, you may be asked subsequent questions to further specify the wound location.

**COMMENT: The definition for "Wound Location" (Page 2) addresses only the abdomen. WOUND LOCATION CHEST AND WOUND LOCATION PELVIS are included for injuries where both an entry and exit point exist and one is other than the abdomen. A definition for WOUND LOCATION CHEST and WOUND LOCATION PELVIS needs to be provided.**

**Trauma Symptom Page 2a: (Accessed only by selecting WOUND LOCATION ABDOMEN)**

WOUND LOCATION ABDOMEN
- A. ANTERIOR
- B. POSTERIOR

**Definition for Wound Location Abdomen.**

Wound location within the abdomen
Anterior is anterior to the mid axillary line.
Posterior is posterior to the mid axillary line.

**COMMENT: In referring to location, the chest and abdominal pain programs reference diagrams as a help to defining specific locations. Figure 2 shows a diagram of the abdomen used in ABDX to collect data regarding Site of Pain. This figure is provided as a reference example.**

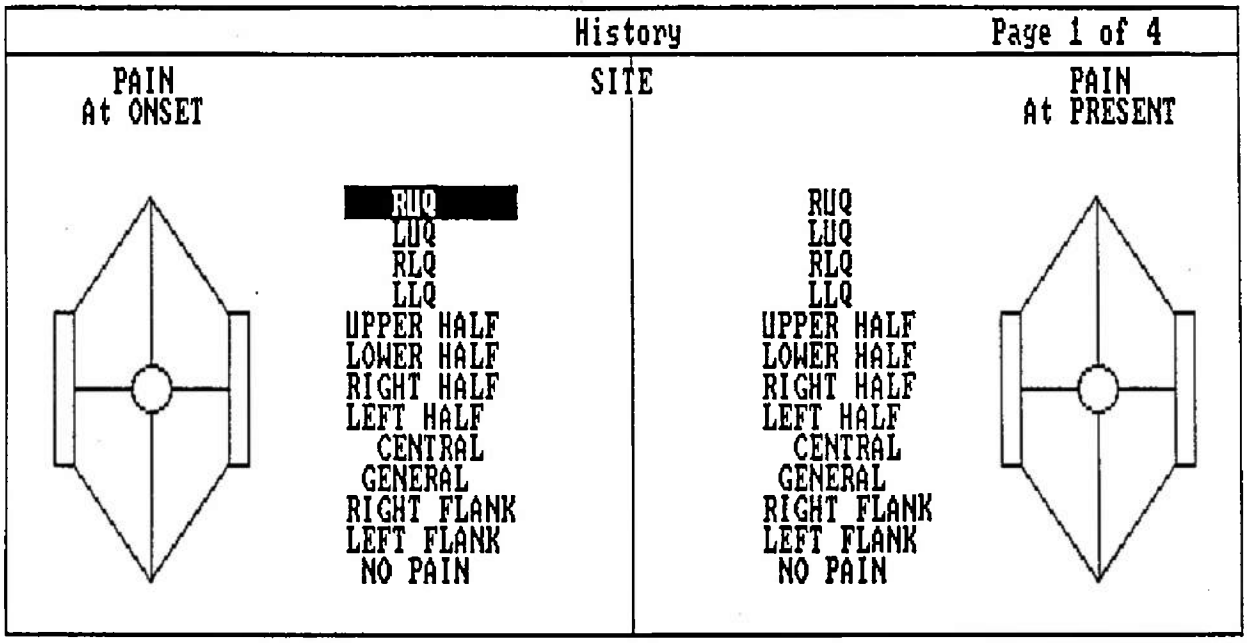



**Figure 2: Abdominal diagram used in ABDX to collect symptom data**

**Trauma Symptom Page 2B: (Accessed only by selecting WOUND LOCATION ABDOMEN ANTERIOR)**

WOUND LOCATION ABDOMEN ANTERIOR

A. EPIGASTRIC
B. LUQ
C. RUQ
D. LLQ
E. RLQ
F. UNSPECIFIED

**Definition for Wound Location Abdomen Anterior:**

Wound location within the anterior abdomen

Quadrants are determined by imaginary horizontal and vertical lines thru the umbilicus (belly button). The upper abdomen is toward the head, (above the umbilicus), the lower abdomen is toward the feet (below the umbilicus). Right and left refer to the patient's right and left. The epigastric area is the upper inverted-V shaped area of the abdomen just below the lower end of the sternum.

COMMENT: In referring to location, the chest and abdominal pain programs reference diagrams as a help to definining specific locations. A similar diagram should be included in the trauma program that identifies LUQ, RUQ, LLQ, etc. Figure 3 shows the abdominal diagram used in ABDX. In this example, the Site of Pain is Right Lower Quadrant and Central. The corresponding areas on the diagram are blackened.

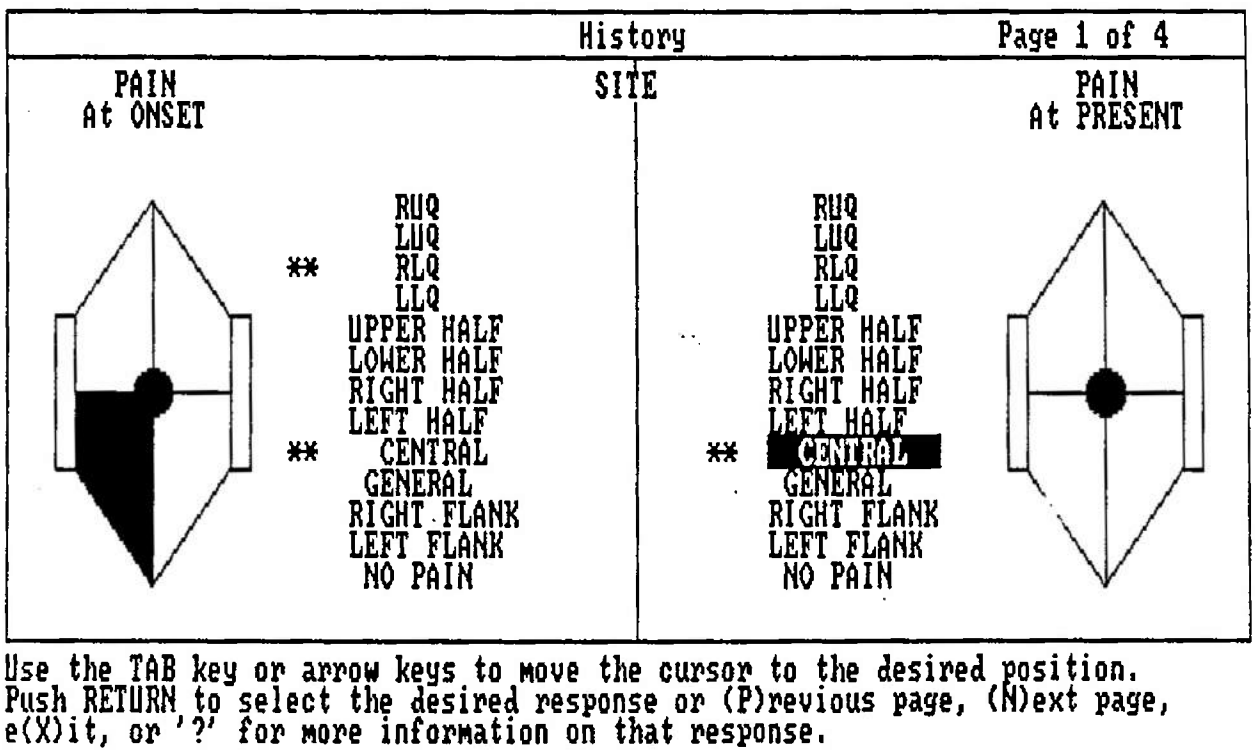



**Figure 3: Abdominal diagram with sites of pain starred and blackened.**

**Trauma Symptom Page 2C: (Accessed only by selecting WOUND LOCATION ABDOMEN POSTERIOR)**

WOUND LOCATION ABDOMEN POSTERIOR
- A. LEFT POSTERIOR
- B. RIGHT POSTERIOR
- C. MIDLINE POSTERIOR
- D. UNSPECIFIED POSTERIOR

**Definition for WOUND LOCATION ABDOMEN POSTERIOR:**

Wound location within the posterior abdomen
Right and left are the patient's right and left. The midline is the area over the spine or the paraspinal longitudinal (up & down) muscles.

**COMMENT: In referring to location, the chest and abdominal pain programs reference diagrams as a help to defininig specific locations. A diagram that specifies left/right/midline posterior should be included in the trauma program.**

**Trauma Symptom Page 3:**

WOUND DIRECTION
- A. UP
- B. DOWN
- C. LEFT
- D. RIGHT

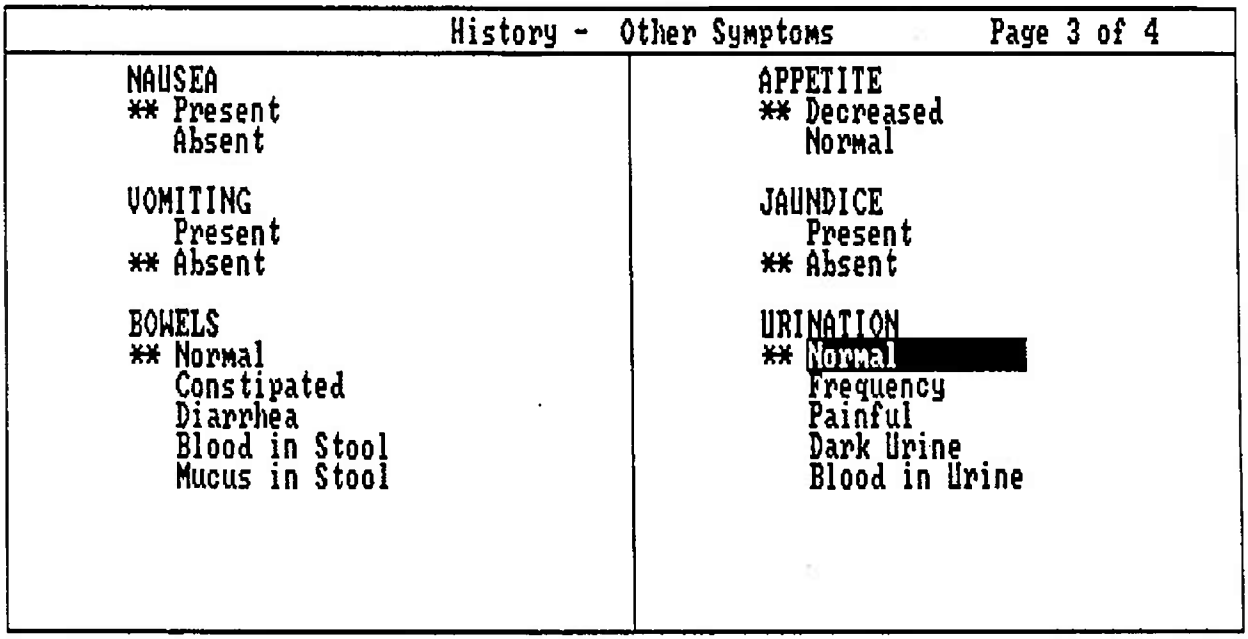
Are there more wounds?

**COMMENT: There is no definition available for "WOUND DIRECTION" (Page 3). The definition should specify whether the wound is "going" to the right or "coming from" the right.**

**Trauma Symptom Page 4:**

FINDINGS:
A. WEAK FEMORAL PULSE  Entering Positive Information
B. LOSS OF MOVEMENT IN LEG Any finding you enter will be
C. LOSS OF MOVEMENT IN LEG interpreted as present.
D. EVISCERATION
E. SHOCK
F. UNCONSCIOUSNESS To enter negative information
G. OBTUNDATION press - (minus sign).
H. DISTENDED ABDOMEN
I. PNEUMOPERITONEUM
J. ABSENT RECTAL TONE
K. TENDERNESS
L. GUARDING
M. REBOUND
N. ILEUS

**COMMENT: In the trauma program, the screen is redrawn after each positive or negative selection is made. The program would be more consistent with ABDX/CPDX if, for each symptom category (Shock, Obtundation, Distended Abdomen, etc.), the findings of PRESENT and ABSENT were displayed. The user moves the cursor to the desired finding, presses RETURN/ENTER and the finding (either PRESENT or ABSENT) is starred. After entering all data for a given page, the user presses "P" (for Previous Page), "N" (for Next Page) or "X" (for Main Menu). Figure 4 shows one of the history datasheet pages for ABDX illustrating this method of data entry. Below it, some of the findings from the trauma program are displayed using the same format.**



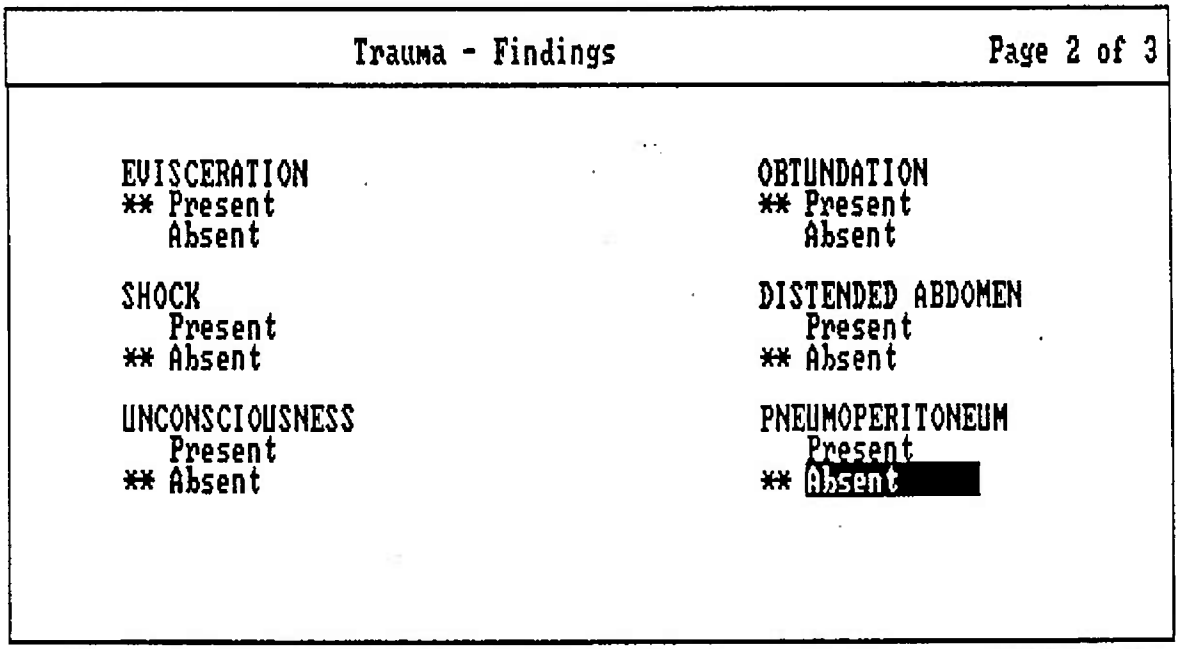




**Figure 4: ABDX history datasheet page and trauma findings displayed using the same format.**

Definition for FINDINGS:

Findings menu

Please enter information about as many of these finding as you can. Some choices in this menu are immediately interpreted as data entry (for example, by selecting shock, you tell the machine that the patient is in shock ,i.e. the blood pressure is below 90/60 mm Hg). On the other hand, some other choices, specifically the first three, cause the machine to ask further clarifying question, specifically, in which leg the findings are observed.

Ordinarily you enter information about findings which are present, but you may also wish to remark that some finding is absent, thereby indicating normal appearance or function. To do this, notice the upper right hand portion of the screen. It indicates the current truth value of an answer. It is ordinarily positive, but you can make it negative by pressing - (the minus sign) in order to enter negative facts. Remember, knowing that something is false can help make a decision.

To get further information on specific choices in this menu press the F1 key again.

Weak pulses in leg: femoral pulse absent or weaker than radial pulse.
Loss of movement of legs: patient is unable to flex and extend toes, ankles, and/or knees.
Loss of sensation of legs: patient is unable to discern or identify touch along the inside and outside of the foot.
Evisceration: bowel, omentum (looks like a freely movable fatty tongue), or other organs visible in the wound.
Shock: blood pressure below 90/60 mm Hg.
Unconciousness: doesn't respond to verbal or painful stimulus.
Obtundation: stuporous, not alert.
Distended abdomen: abdomen protuberant (sticks out) more than usual or expected for this patient.
Pneumoperitoneum: patient is tympanic to percussion over the liver (right lower rib cage and right upper quadrant of the abdomen) when the right side is up, but not when the right side is down.
Absent rectal tone: no resistance of the anal sphincter when a digital rectal examination is done with a gloved, lubricated finger.
Tenderness: pain on palpation of the abdomen.
Guarding: involuntary contraction of abdominal muscles when palpated.
Rebound: pain when the hand is removed after pressing on the abdomen.
Ileus: no bowel sounds in 2 minutes of listening to the abdomen.

COMMENT: In ABDX/CPDX, the definition of a finding is accessed by highlighting the finding with the cursor and then pressing a special key ("Shift ?"). The trauma program uses two different formats in defining findings and tests. The definition for all findings are presented in a single group and the definition of each test is presented individually. The format used to provide definitions for tests is similar to that used in ABDX/CPDX. Definitions of symptoms used in ABDX/CPDX are more extensive than the ones currently provided in the trauma program and, wherever possible, provide an operational explanation of how to collect data relating to that symptom category. For example, the definition of Inspection, a sign used in ABDX is shown in FIgure 5.

INSPECTION definition:

NORMAL
VISIBLE PERISTALSIS
DECREASED ABDOMINAL MOVEMENT

Inspection of the abdomen means closely looking at it! If wave-like movement of any area of the abdomen, especially if accompanied by audible rushes or bowel sounds, mark VISIBLE PERISTALSIS.

To observe for DECREASED ABDOMINAL MOVEMENT, the patient should lie on his back with flexed knees while the practitioner holds his hand approximately 1 to 2 inches above the patient's umbilicus. The patient is then asked to raise his belly to touch the practitioner's hand. If the patient has difficulty doing this, mark DECREASED ABDOMINAL MOVEMENT. This sign is an important indicator suggestive of peritonitis.

Figure 5. Definition of Inspection, a sign used by ABDX.

**Trauma Symptom Page 5:**

TESTS:

A. LOCAL WOUND
B. NASOGASTRIC ASPIRATE GUIAC
C. STOOL GUIAC
D. URINALYSIS RED BLOOD CELLS
E. ARTERIOGRAM
G. ABDOMINAL XRAY
H. LUMBAR SPINE XRAY
I. PELVIC XRAY
J. INTRAVENOUS PYELOGRAM
K. CYSTOGRAM
L. GASTROGRAFFIN UGI
M. PERITONEAL LAVAGE

**Definition for TESTS:**

Tests menu

There are two kinds of tests on this menu: those that can be performed on board (the first four tests) and those that cannot (the rest). The system might ask you questions about the first four, or you may enter results of these tests without the system's specific prompting. If the system needs to know results about any of the unavailable tests, it will make a hypothetical 'safe' assumption about its possible result and move on. You may examine the system's reasoning by providing hypothetical results for these tests yourself.

For a specific explanation for a test, select it from the menu and then press F1.

Local Wound Exploration

The depth of the wound should be inspected (not palpated) by retracting the edges. If necessary, the ends of the wound infiltrated with 1% xylocaine and a scalpel used to extend the incision far enough to make inspection of the depth possible. Local Wound Exploration is negative if the deepest part of the wound is not deeper than the subcutaneous fat. Otherwise, the Local Wound Exploration is positive. The wound should NEVER be probed with a finger or instrument to determine its depth.

Nasogastric aspirate

A nasogastric tube is inserted in the usual fashion. The stomach contents are aspirated and tested by the guiac test for occult blood.

Stool Guiac

The stool should be tested for blood with the guiac test in the standard way.

Urinalysis red blood cells

Ideally the presence of red blood cells in the urine should be determined by microscopic examination of centrifuged urinary sediment. Alternatively a urinary chem-strip can be used to detect the presence of hemoglobin. If the urine appears red, the presence of blood should ideally be confirmed by examination of the urine.")

**COMMENT: Definitions are provided for only the first four tests. A definition for each test should be included, even though the test may not be currently performed on board the ship. Alternately, these tests should be removed from the current version of the program.**

**Trauma Main Menu Page:**

MTCS-PC MAIN MENU

A. ADD/CHANGE
B. ANSWER SYSTEM'S QUESTIONS (IF ANY)
C. RESET SYSTEM (NEW PATIENT)
D. EXIT MTCS-PC

**COMMENT: To access the main menu, the user must "escape" through remaining data sheet pages. The main menu should be located directly after the title page. Allow the user to exit directly to the main menu by use of a special key. In the abdominal and chest pain programs, the user exits to the main menu by pressing "X".**

**Help for Page 6:**

Use this menu to decide what to do next. If you haven't already done so, select choice B to answer system's questions, this could be extremely important. If you would like to add or change any information, select choice A. If you have finished consulting with the system about this patient, use choices C or D. To see everyting you've entered, along with any conclusions and recommendations that the system has made, press F10. To exit MTCS-PC back to the DOS prompt, select option D. More documentation is available in the MTCS-PC manual.

COMMENT: The comments up to this point have been specific to successive display pages of the trauma program. In addition, some overall differences exist between the formats of the trauma and ABDX/CPDX programs that relate to data entry and program usage. They are listed below.

1. Accessing Previous and Next Pages

The abdominal and chest pain programs allow the user to return to previous pages and continue to next pages by use of the letter keys "P" (Previous Page) and "N" (Next Page), respectively. The user can add or change information by accessing the appropriate datasheet page and then entering the desired change. In order to access previous pages in the trauma program, the user must ESC through successive pages to the main menu and then select ADD/CHANGE information.

2. Data Entry

In ABDX/CPDX, findings are highlighted by a cursor. The user selects a finding, by using the arrow keys (up, down, left, right) or letter keys (U,D,L,R) to move the cursor to the desired finding and then pressing the RETURN/ENTER key. Selected findings are starred (**). To remove a finding, the user highlights it with the cursor and then presses the RETURN/ENTER key. Stars are deleted (**) and the finding is removed. In the trauma program, findings are entered by selecting the letter key associated with the finding. To remove an entry, the finding is re-entered by letter key. The current status of the symptom is then displayed (e.g. True/False) and the user can make changes to the entry.

3. Special Function Keys

Another difference between the trauma program and the existing diagnostic programs is the use of special function keys. ABDX/CPDX use alternate keys since the corpsman aboard the submarine may not have access to a computer with special function keys.

Table 1 lists some of the keys used in the programs along with their purpose.

Table 1 - Special Function Keys used in ABDX/CPDX and the Trauma Program

| Purpose | ABDX/CPDX | TRAUMA |
|---|---|---|
| Help | "?" | F1 |
| Next Page | "N" | ESC |
| Previous Page | "P" | ESC |
| Exit to previous menu | "X" | ESC |
| Obtain Diagnosis | Menu selection | F10 |
| Data Entry | Cursor/Return key | Letter key |

SECTION II

We have attempted to put the trauma program into a format similar to that of the abdominal pain and chest pain programs. Hard copies of pages from the altered trauma program are presented on the following pages.

NAME: Title Page
DESCRIPTION: The title page presents the name of the program, the developers and their address.

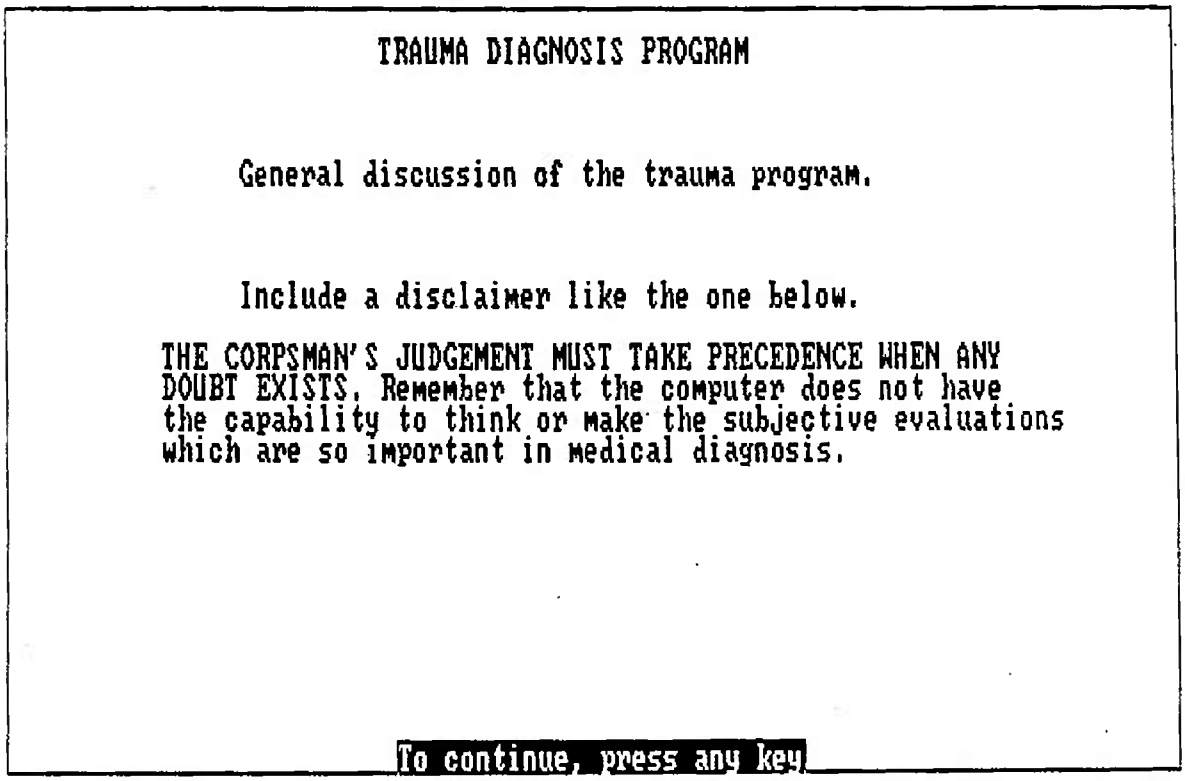
COMPUTER-ASSISTED DIAGNOSIS PROGRAM
FOR
ACUTE TRAUMA


Developed by:
NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY
Box 900, SUBASE NLON
GROTON,CT 06349-5900

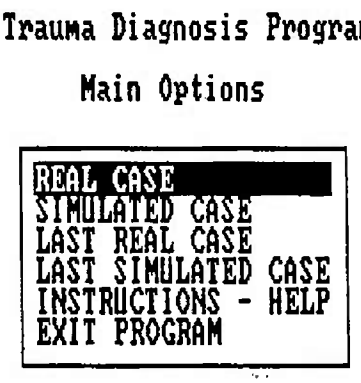
Phone: (203)-449-3668, 4894
AV 241-3668, 4894

To continue press any key

NAME: Program Description Page
DESCRIPTION: This page provides a general description of the program.



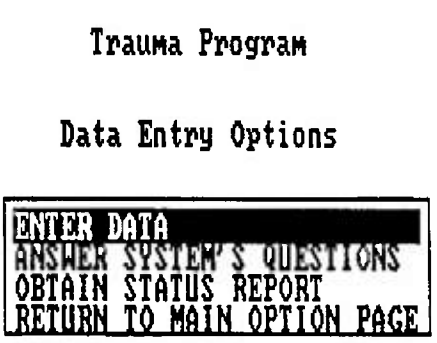
NAME: Main Option Page
DESCRIPTION: This page contains the main menu selections. The user can choose to enter data for a real or simulated case, retrieve the findings for the last real or simulated case, access instructions on the use of the program, or exit the system.



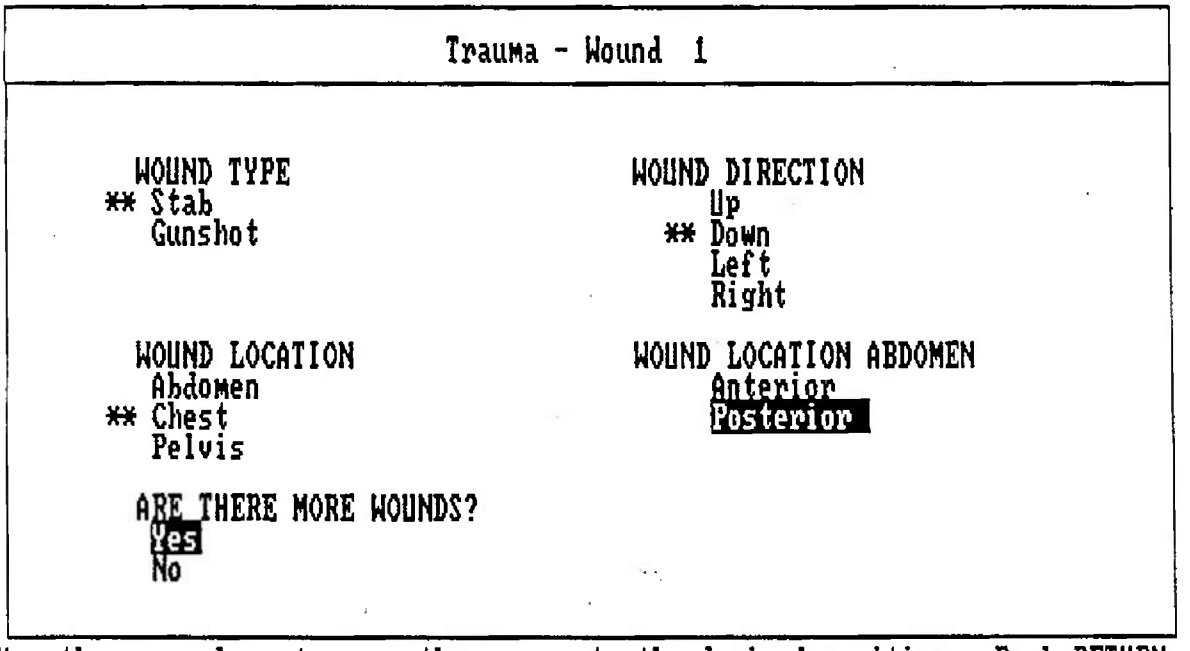
NAME: AGE/DATE/SSN Page
DESCRIPTION: The user enters the patient's age and SSN (if a real case) and checks the date and time of the exam.

```
Enter Pt's age in years:  44

Date of exam is 04-27-1988.  Is this correct ( Y or N )?

Time of exam is  10:35.  Is this correct ( Y or N )?

SIMULATED case chosen for patient 000-00-0000 for 04-27-1988 at 10:35.

To continue, press any key
```

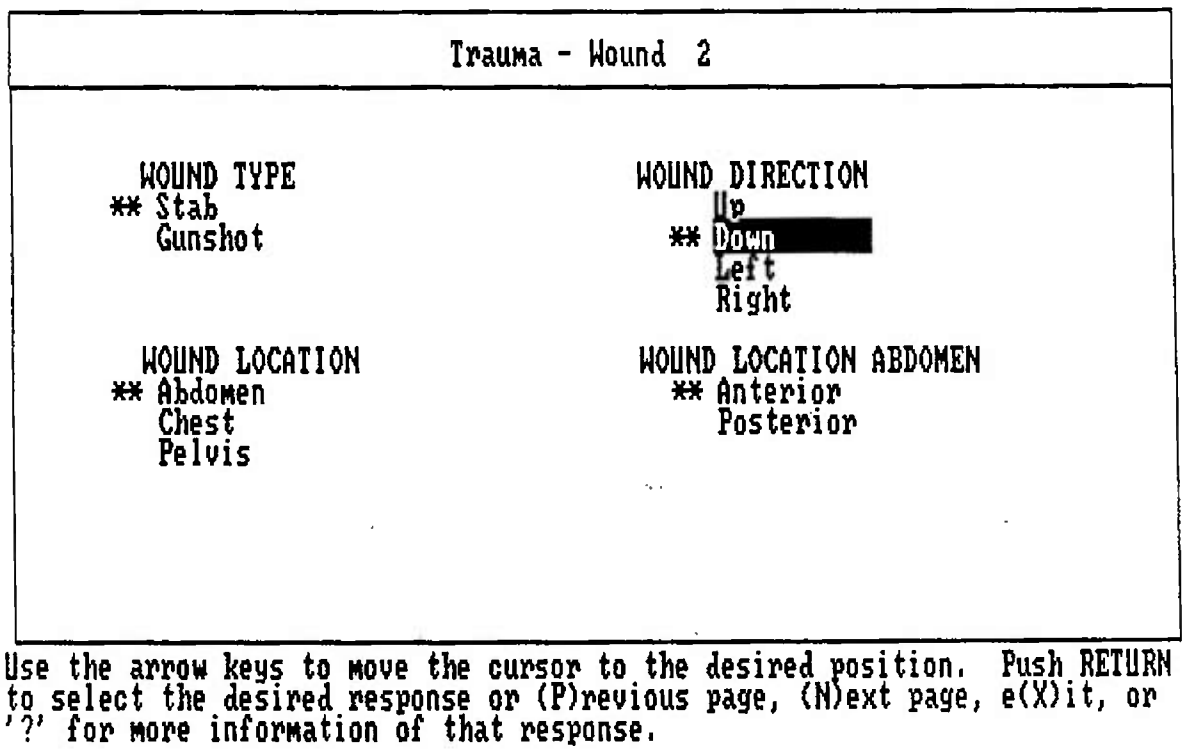
NAME: Data Entry Option Page
DESCRIPTION: This page contains data entry options for the trauma program. The user selects whether to enter data, answer the system's questions, obtain a status report on the patient, or return the main option page.



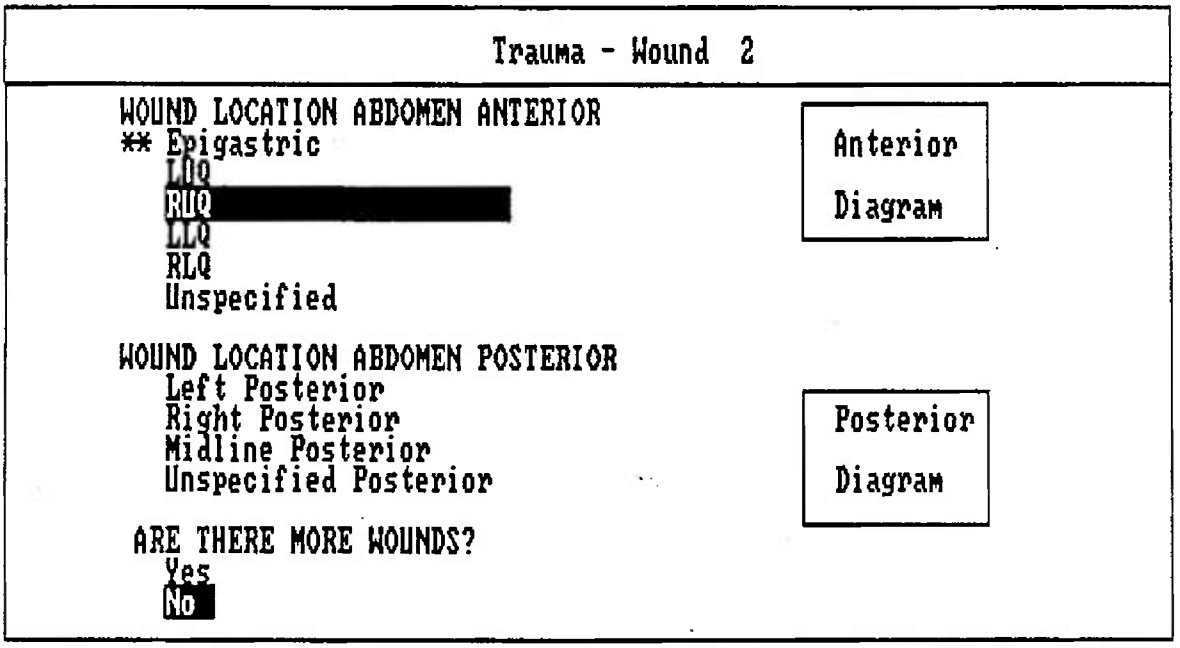
NAME: Datasheet Display Page
DESCRIPTION: The user enters findings for type, location, and direction for Wound 1 on this page.



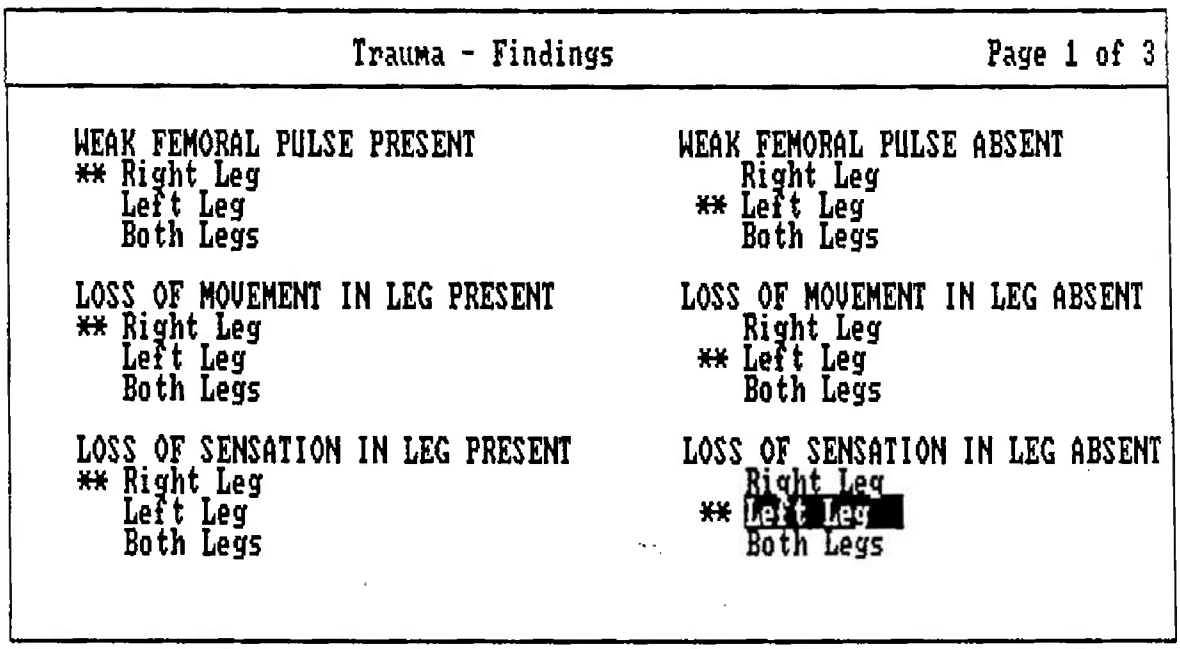
NAME: Datasheet Display Page
DESCRIPTION: The user enters findings for type, location, and direction for Wound 2 on this page. In this example, data for only two wounds have been entered. The program can accomodate information on any number of wounds.



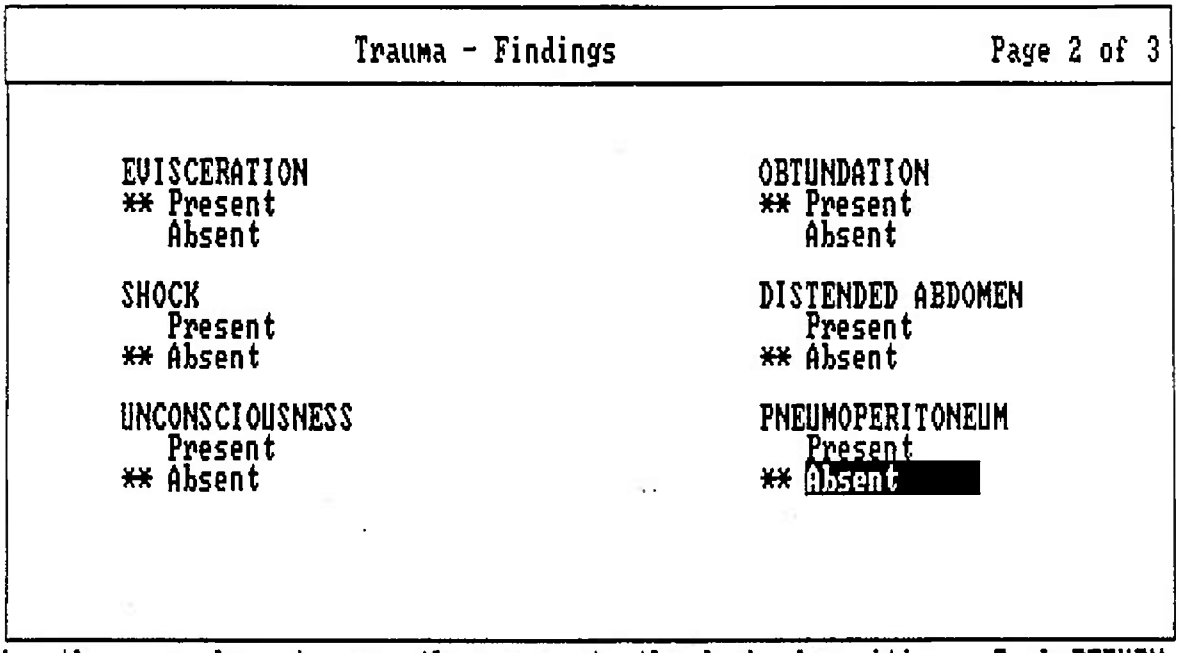
NAME: Datasheet Display Page
DESCRIPTION: This page requests additional information on the location of the wound to the abdomen.



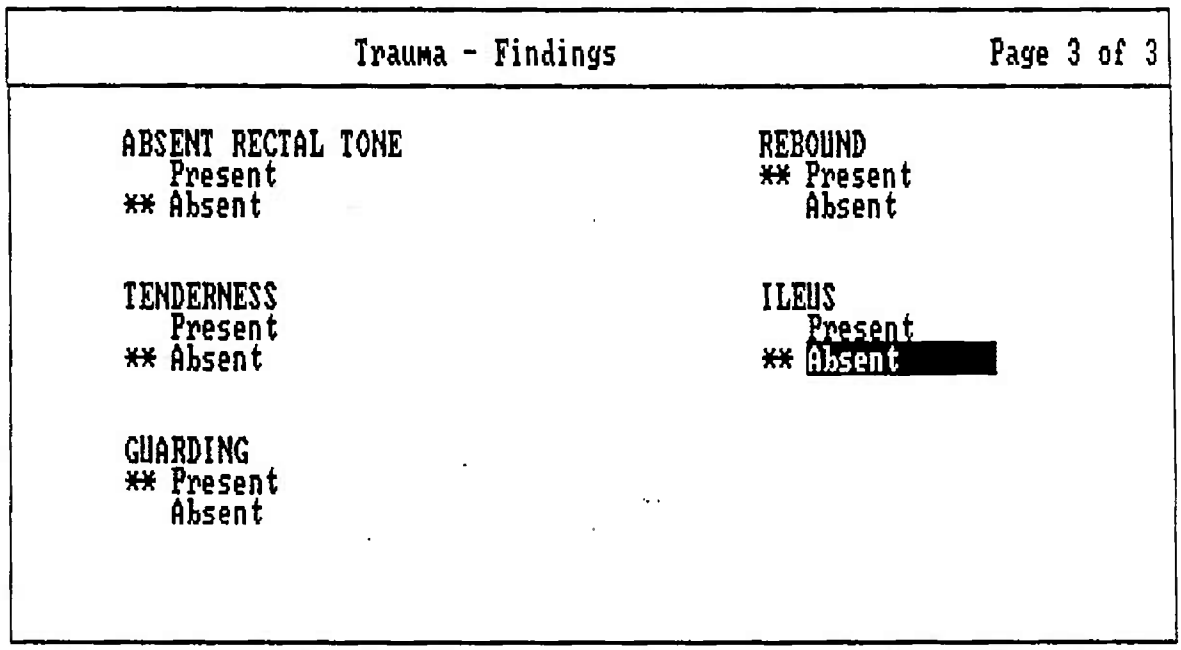
NAME: Datasheet Display Page
DESCRIPTION: The user enters trauma findings on this page. This is the first of three pages of trauma findings.



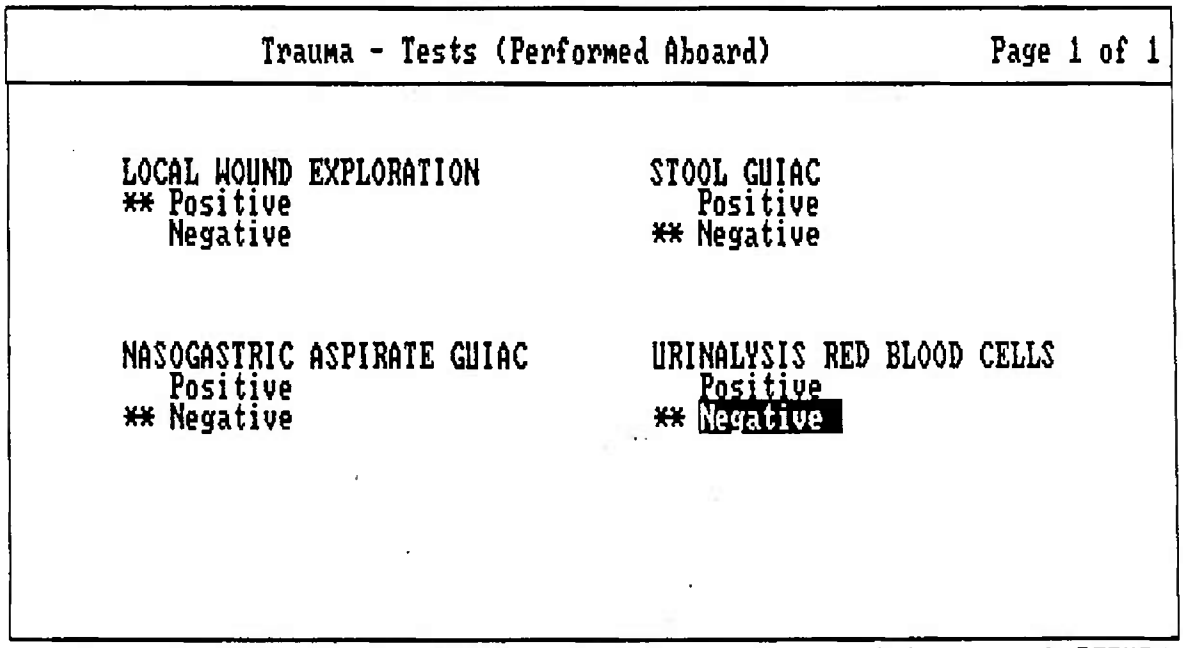
NAME: Datasheet Display Page
DESCRIPTION: The user enters trauma findings on this page. This is the second of three pages of trauma findings.



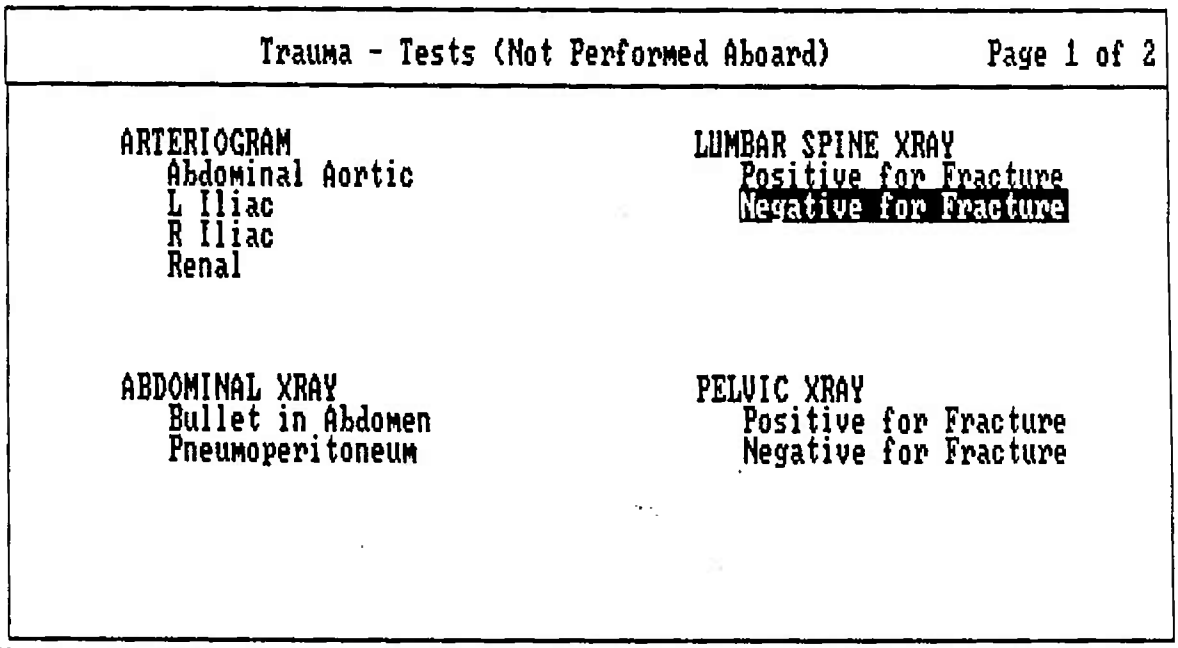
NAME: Datasheet Display Page
DESCRIPTION: The user enters trauma findings on this page. This is the third of three pages of trauma findings.



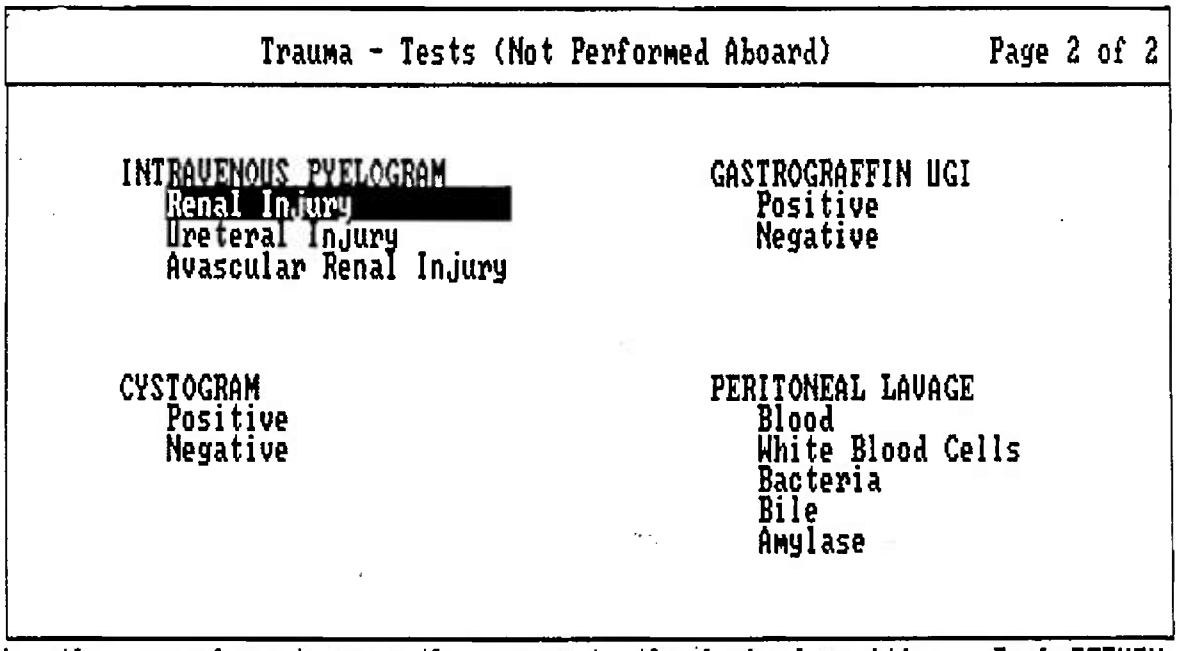
NAME: Datasheet Display Page
DESCRIPTION: The user enters results of tests performed aboard ship on this page. The definition of a particular test is accessed by highlighting the test with the cursor and entering "?". For example, the definition of Local Wound Exploration (see page 12) provides information on how to explore the wound. In addition, it defines what the program means by Negative Local Wound Exploration (the deepest part of the wound is not deeper than the subcutaneous fat) and Positive Local Wound Exploration (anything else).



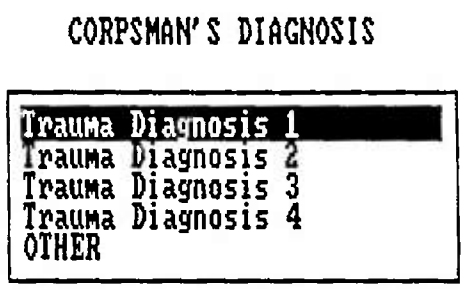
NAME: Datasheet Display Page
DESCRIPTION: The user enters results of tests on this page. The tests on these pages are not currently performed aboard submarines and could be removed from this version of the trauma program. They are included in the program for use in other environments, such as surface ships. Findings for these tests are not required for the program to provide a diagnosis. This is the first of two pages of tests not performed aboard.



NAME: Datasheet Display Page
DESCRIPTION: The user enters results of tests (not performed aboard ship) on this page. This is the second of two pages of tests not performed aboard.

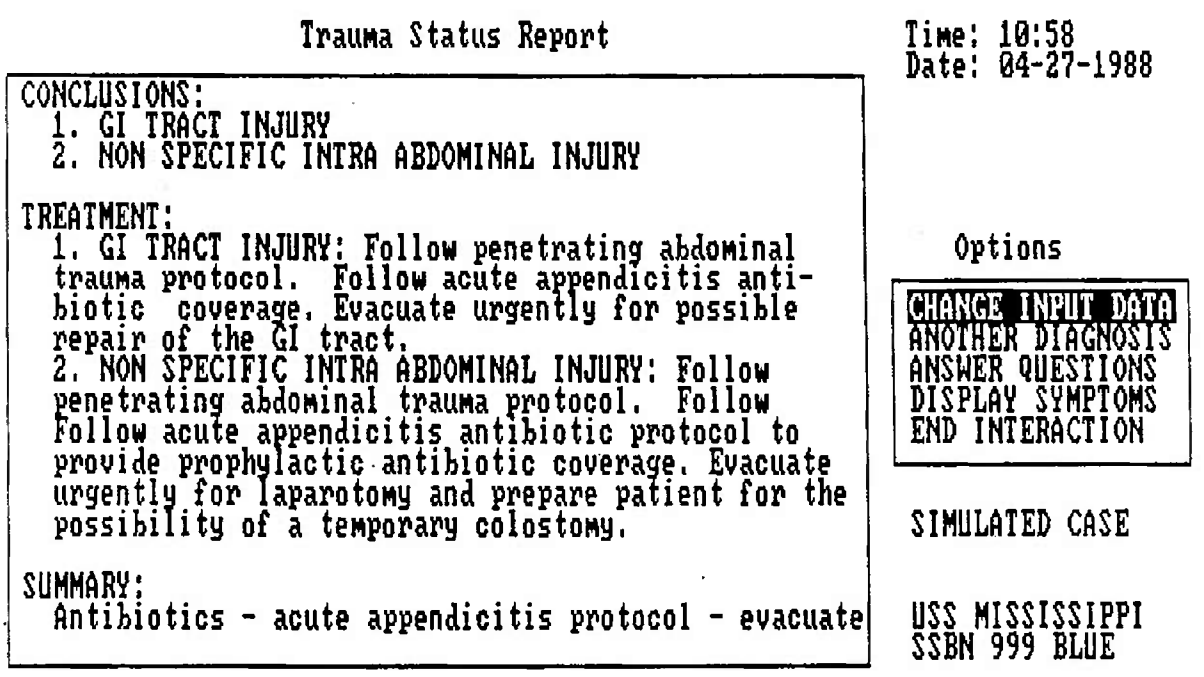


NAME: Corpsman's Diagnosis Page
DESCRIPTION: The user is requested to enter a diagnosis for the patient before seeing the computer-based diagnosis.



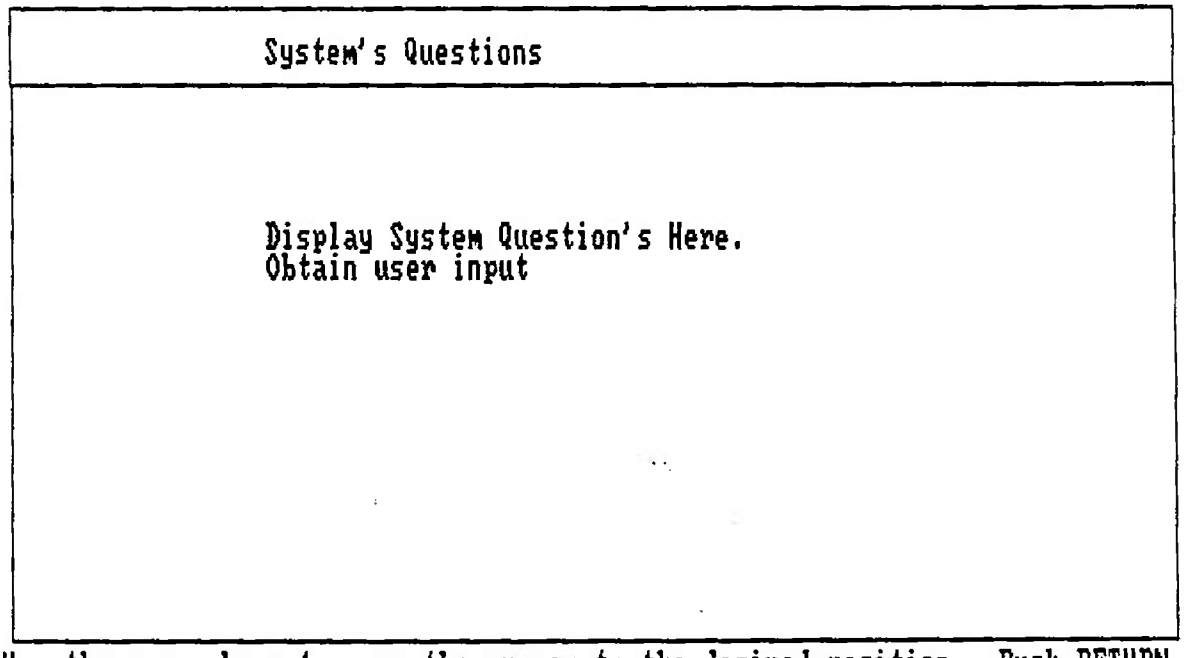

Use the arrow keys to move the cursor to the desired position. Push RETURN to select the desired response or '?' for more information.

NAME: Trauma Status Report
DESCRIPTION: This page presents the trauma diagnosis based on the findings entered for the patient and appropriate treatment suggestions. The user selects whether to make changes to the symptom data for the patient, enter the findings on a new case, answer the system's questions based on the findings already entered, obtain a listing of the symptoms entered, or exit the system.




Use the arrow keys to move the cursor to the desired position. Push RETURN to select the desired response or '?' for more information.

NAME: System Questions Page
DESCRIPTION: This page requests the user to answer system questions based on the data already entered for this patient.




Use the arrow keys to move the cursor to the desired position. Push RETURN to select the desired response or (P)revious page, (N)ext page, e(X)it, or '?' for more information of that response.

NAME: Symptom Listing Page
DESCRIPTION: This page lists the symptoms that have been entered for the patient.

```
Symptom Listing - Trauma    (Real Case): 211-11-1111        16:53 01-22-88
-------------------------------------------------------------------------

     STAB WOUND
     LOCATION - LUQ
     WOUND DIRECTION -RIGHT
     LOCATION - CHEST
     WOUND DIRECTION - UP
     UNCONSCIOUSNESS
     DISTENDED ABDOMEN
     GUARDING
     REBOUND TENDERNESS
     STOOL - GUIAC POSITIVE
     LOCAL WOUND EXPLORATION - POSITIVE
     PNEUMOPERITONEUM
     NO WEAK PULSES L LEG
     NO WEAK PULSES R LEG
     PERITONEAL LAVAGE POSITIVE FOR WBC (assumed true)




-------------------------------------------------------------------------

     Enter (P)revious, (N)ext, e(X)it, or ? for help
```

SUMMARY

The purpose of this memo report is to examine from a human factors point of view the display format of Clarke's computer-based diagnostic program for penetrating wounds to the abdomen. The report compares the display of the trauma program to that of the abdominal pain and chest pain diagnostic programs, so that programs can be as similar as possible without loss of program content or the need for extensive training on new modules. Section I presents suggestions to the format of the current trauma program and in Section II, the trauma program is presented in the same format used with ABDX/CPDX.

## DISCLAIMER

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report examines a computer-based trauma program for wounds to the abdomen developed by John Clarke, M.D. at the Medical College of Pennsylvania, Philadelphia, PA. The report compares the display format of the trauma program to that of the existing abdominal pain (ABDX) and chest pain (CPDX) diagnostic programs. Format differences are identified and changes are suggested to make the format of the trauma program more consistent with that of ABDX/CPDX.

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